MONTANA
CARDIOVASCULAR HEALTH PROGRAM

MONTANA
Department of Public Health & Human Services

THE BURDEN OF **HEART DISEASE AND STROKE** IN THE **BIG SKY STATE**

MONTANA 2007

ACKNOWLEDGEMENTS

This report was prepared by the Cardiovascular Health and Diabetes Programs, Chronic Disease Prevention and Health Promotion Section, Public Health and Safety Division, Montana Department of Public Health and Human Services. The following individuals contributed and were involved in the development and preparation of this report: Carrie S. Oser, MPH; Dorothy Gohdes, MD; Todd S. Harwell, MPH; Michael J. McNamara, MS; Crystelle Fogle, MBA, MS, RD and Steven D. Helgerson, MD, MPH.

The authors would like to give special thanks to the following individuals and organizations for their technical support and contributions to this report:

- Susan Cummings, BSN, CPHQ, Behavioral Risk Factor Surveillance System (BRFSS) Coordinator, Public Health and Safety Division
- David Fulgham, PhD, Mortality Statistician, Office of Vital Statistics
- Bruce Schwartz, MA, MPA, Research Specialist, Office of Vital Statistics
- Billings Area Indian Health Service

We acknowledge the following organizations for their continued support of the Cardiovascular Health Program:

- American Heart Association
- Centers for Disease Control and Prevention
- Montana Cardiovascular Disease/Obesity Prevention Task Force
- Montana Stroke Workgroup

Front cover painting: *Runoff* by Mike Chapman
Back cover photograph: *Old Man of the Hills and Walling Reef, 2006* by Todd S. Harwell

PREFACE

This updated cardiovascular burden report is intended to complement Montana's 2006-2010 Heart Disease and Stroke State Plan. The report provides a detailed view of heart disease, stroke and cardiovascular risk factors in Montana. Although the burden report identifies encouraging trends in cardiovascular disease mortality for our state, it also highlights the growing prevalence of cardiovascular risk factors in Montanans, particularly in American Indians.

EXECUTIVE SUMMARY

Cardiovascular Disease Mortality in Montana

In 2005, cardiovascular disease (CVD) remains the leading cause of death in Montana with the majority of these deaths (30%) due to heart disease and stroke.

- Since 1979, cardiovascular disease age-adjusted mortality rates have fallen in the US and in Montana by almost 42% and 55%, respectively.
- In 2005, heart disease and stroke were the second and fourth leading causes of death. In comparison, in 2000, heart disease and stroke were the first and third leading causes of death, respectively.
- Significant health disparities exist in Montana's largest minority group, American Indians (AI). From 1990-2005, Montana American Indians experienced higher age-adjusted mortality rates from CVD than non-Indians in the state.

Cardiovascular Risk Factors in Montana

- Montana American Indians' prevalence of diabetes increased from 12% in 1999 to 19% in 2005. During the same timeframe, this population's prevalence of high blood pressure rose from 26% to 37%. Montana American Indians' prevalence of obesity was almost twice that of all Montanans and US adults from 1999 to 2005.
- From 1990 to 2005, the prevalence of high blood pressure rose from 19% to 24% for Montana adults. During that period, the prevalence of high blood cholesterol among Montana adults rose from 25% to 33%. One out of five Montana adults was obese in 2005.

Signs/Symptoms Awareness

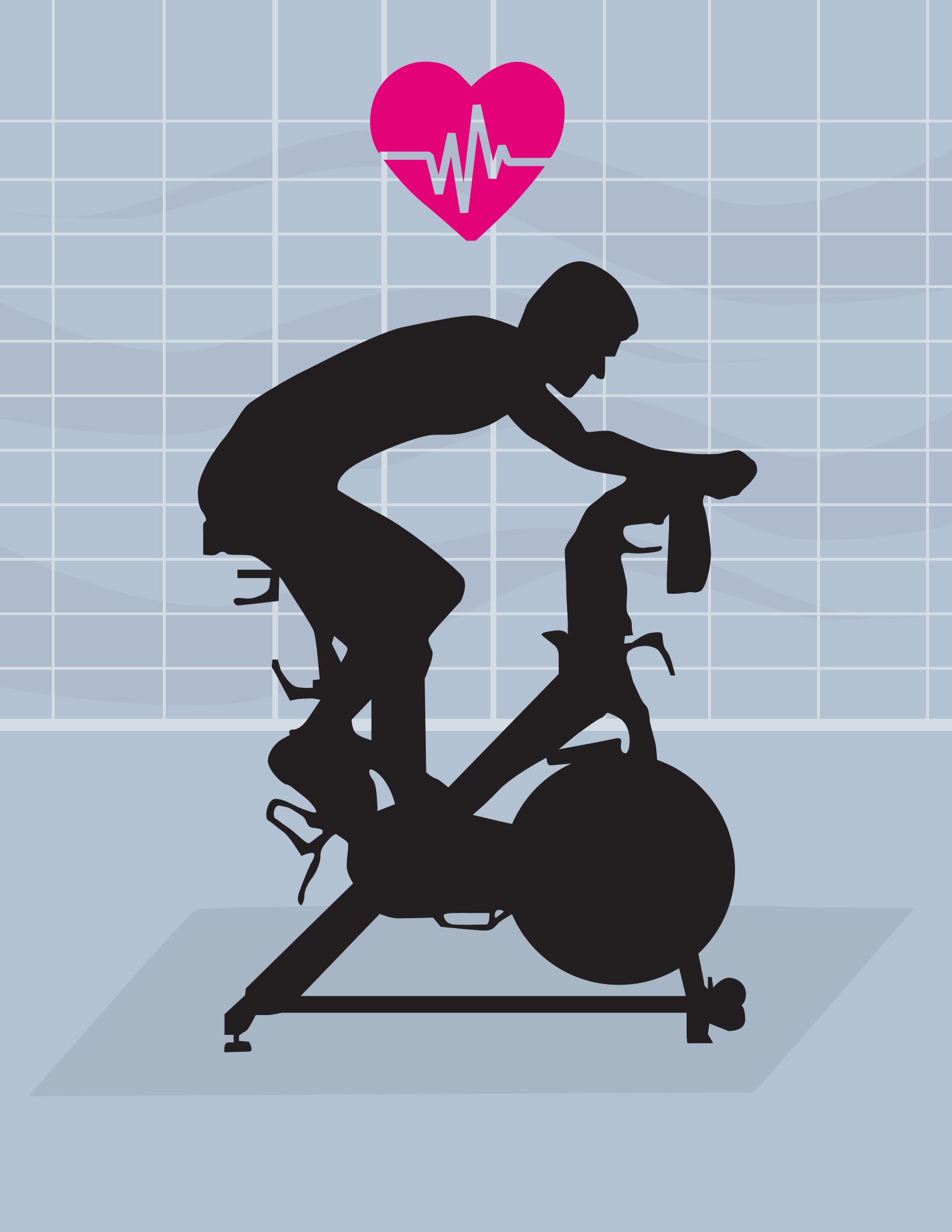
- From 2003 to 2005, older Montana BRFSS respondents increased their knowledge of four or more stroke and heart attack signs and symptoms.

Discharge Data

- Heart failure age-adjusted hospital discharge rates have increased from 2001 to 2005.
- Among Montana residents, age-adjusted stroke and coronary heart disease hospital discharge rates decreased slightly from 2001 to 2005.

TABLE OF CONTENTS

LIST OF FIGURES



INTRODUCTION

Cardiovascular disease (CVD) is the leading cause of death in Montana. Many Montanans have experienced a heart attack, heart failure or stroke, and many others are at risk for serious but preventable cardiovascular disease. Public health efforts to reduce the burden of cardiovascular disease are growing in the state. The approaches include:

- promoting public awareness of risk factors and symptoms of heart attack and stroke and the need to use 911
- coordinating care to reduce risk factors for both primary prevention and prevention of recurrent events
- working with physician offices to improve hypertension and lipid control

Surveillance related to cardiovascular disease in Montana gives the framework for the comprehensive Cardiovascular Health Program and provides information for all Montanans about progress in controlling the risk factors and reducing the morbidity and mortality in Montana. This document updates the 2003 Burden of Cardiovascular Disease in Montana and contains updated data from a variety of sources. Policy makers, health care providers, emergency response personnel, health department workers and many other individuals can use the information contained in this update to guide activities and assess progress in reducing cardiovascular disease in Montana communities.

MONTANA DEMOGRAPHICS

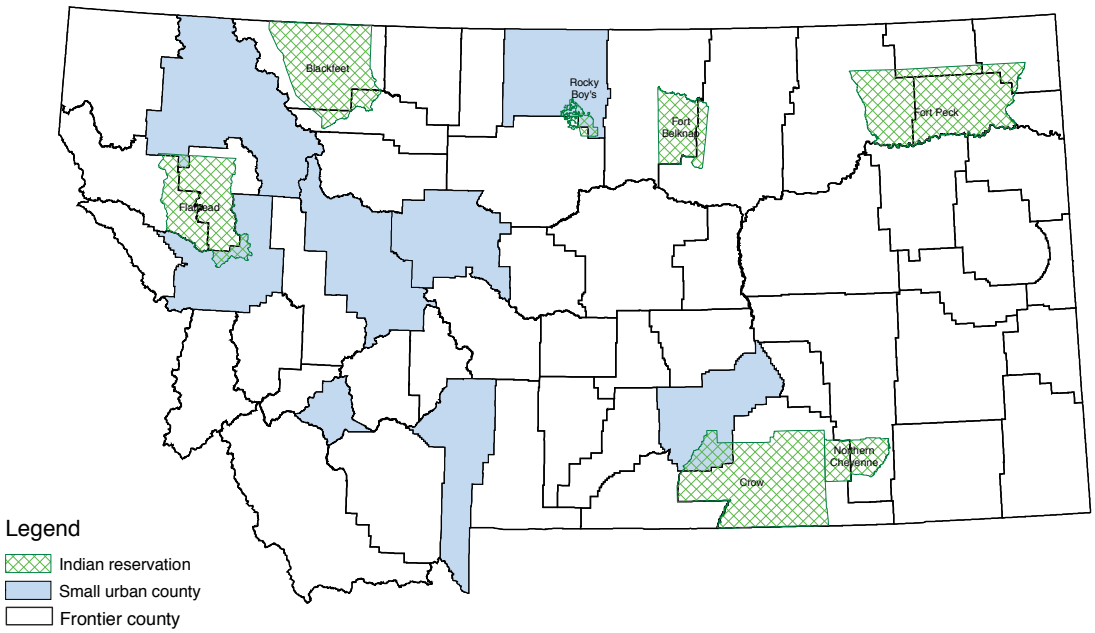
Montana is the fourth largest state in the United States but has a relatively small population. In 2005, the estimated total population of Montana was 935,670 with a population density of approximately 6.4 persons per square mile. The median age was 40.2 years, 50% were women and 13% of Montana residents were 65 years of age or older. Of the 56 counties in Montana, 48 were defined as "frontier" (non-metropolitan counties without a city of 10,000). The remaining eight counties were defined as "small urban" counties with over 60% of the states' population residing in these counties. Over 90% of Montana's population is white with approximately 6% of the population being American Indian – Montana's largest ethnic population. (Figure 1)

Over 62% of the population lives in one of eight counties. These counties, defined as "small urban," range in population from 16,304 to 136,691. A small urban county is a non-metropolitan county with a city of > 10,000 population or a county in metropolitan areas with less than one million population. (1) In contrast, the remaining 48 counties in Montana are defined as "frontier," meaning a non-metropolitan county without a city of 10,000 or more population. (1) In 2005, population estimates in the frontier counties ranged from 470 to 39,940 with seven of these counties having fewer than 1,500 residents and 45 of these counties having a population density of six or fewer persons per square mile. (2) This report compares trends in mortality between frontier and small urban counties.

Another important feature of Montana's population is the economic characteristics of the state. In 2005, the median household income for Montana was almost 15% less than the US, ($39,301 compared to $46,242) (2) although the median household income for Montana American Indians was only $25,696 compared to $40,354 for the white population. In terms of wages, in 2003, eight of the top 10 poorest counties in America were located in Montana's frontier counties. (3) In 2005, the Behavioral Risk Factor Surveillance System (BRFSS) found that 22% of all Montanans reported having no health care coverage, and this rate of uninsured Montanans has increased steadily from 15% in 2000. Unfortunately, the rate of uninsured Montana adults is seven percentage points higher than the comparable national figure of 15%. (4) Uninsured adult Montanans were likely to be younger and report lower income and less education than adults with health care coverage (data not shown).

[Note: The terms "small urban" and "frontier" are used in this document as general descriptors only.]

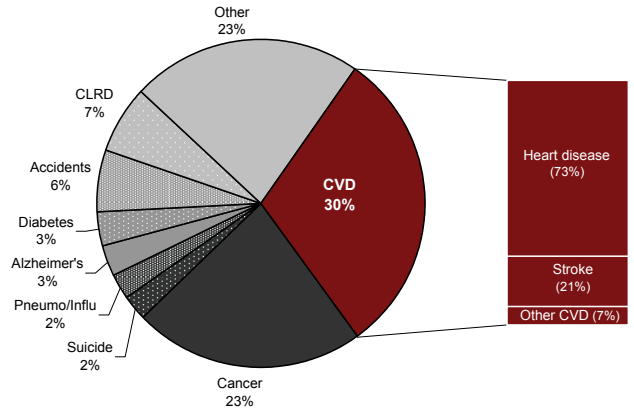
Figure 1. Map of Montana Indian reservations and type of county, 2005



In 2005, almost one-third of all deaths in Montana were attributed to CVD. (Figure 2) Heart disease and stroke were the second and fourth leading causes of death, respectively. In 2005, CVD caused 2,538 deaths among Montanans, 1,842 deaths from heart disease, 521 deaths from stroke and 175 from other CVD. Of all the deaths attributed to CVD, the vast majority was caused by heart disease (73%) and stroke (21%). The leading cause of death among Montana's American Indian population was CVD (22%) in 2005. Heart disease and stroke were the second and fifth leading causes of death, respectively, among American Indians in 2005. (Figure 3)

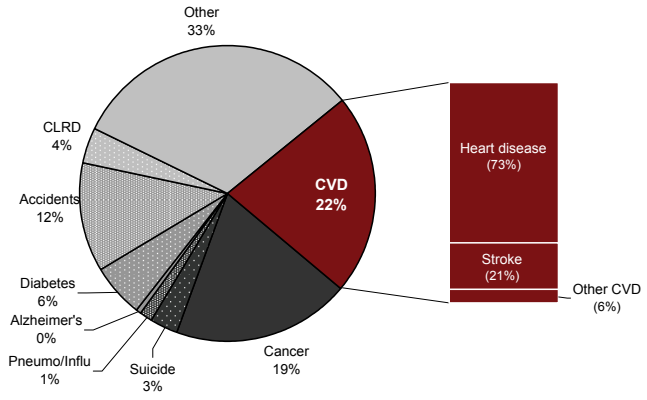
[Note: In this document, some percentage totals may exceed 100% due to rounding.]

Figure 2. Leading causes of death, Montana, 2005



Data source: Montana DPHHS, Office of Vital Statistics, 2005

Figure 3. Leading causes of death among Montana American Indians, 2005

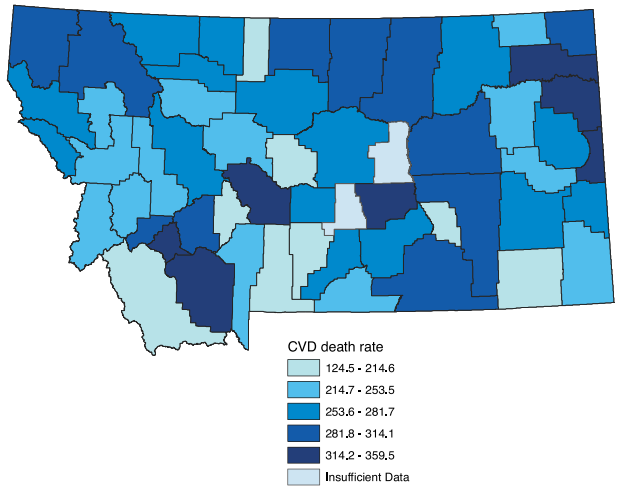


Data source: Montana DPHHS, Office of Vital Statistics, 2005

CARDIOVASCULAR DISEASE

Montana counties with the highest age-adjusted CVD mortality rates were scattered throughout the state. (Figure 4)

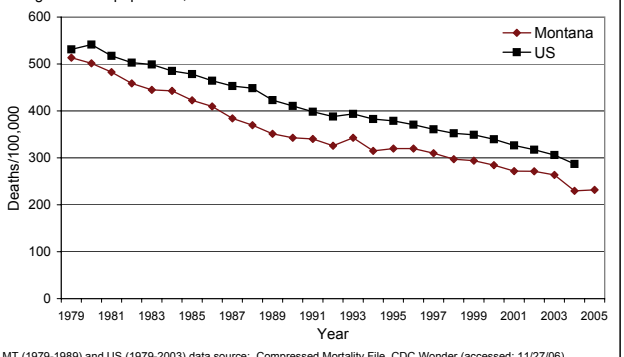
Figure 4. Age-adjusted cardiovascular disease death rate, by county, Montana, 1999-2005



Data source:
Montana Department of Public Health and Human Services, Office of Vital Statistics

♥CVD age-adjusted death rates in the US exceeded the comparable rates for Montana in recent years. CVD age-adjusted mortality has declined steadily in the US (42% decrease) and in Montana (55% decrease) since 1979. (Figure 5)

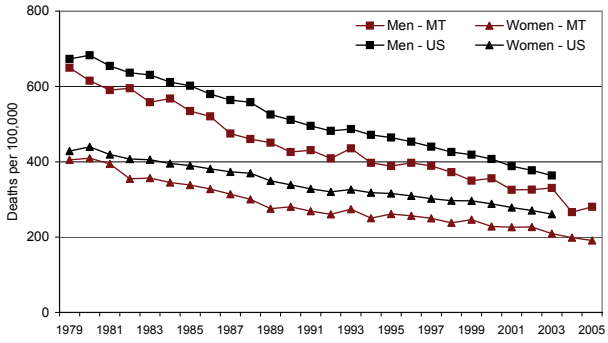
Figure 5. Age-adjusted cardiovascular disease mortality rates for Montana and the general US population, 1979-2005



MT (1979-1989) and US (1979-2003) data source: Compressed Mortality File, CDC Wonder (accessed: 11/27/06)
CVD mortality rate for US not available for 2005.
MT (1990-2005) data source: Montana DPHHS, Vital Statistics

♥CVD mortality rates among both men and women in the US were higher when compared to Montana men and women, respectively. The rate of decline in CVD mortality was less rapid for women than for men. (Figure 6)

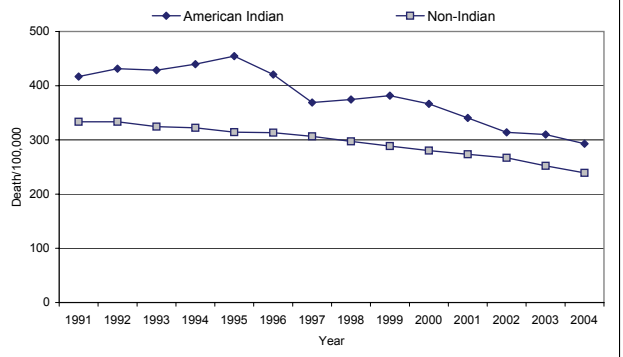
Figure 6. Age-adjusted cardiovascular disease mortality rates for Montana and the general US population, by gender, 1979-2005



MT (1979-1989) and US (1979-2003) data source: Compressed Mortality File, CDC Wonder (accessed: 1/22/07)
Cardiovascular disease mortality rate for US men and women not available for 2004 and 2005
MT (1990-2005) data source: Montana DPHHS, Vital Statistics

♥American Indians in Montana experienced higher age-adjusted mortality rates from CVD than non-Indians in Montana from 1990-2005. Although the CVD mortality declined both in American Indians and non-Indians in Montana during the same time period, the disparity has remained relatively constant. (Figure 7)

Figure 7. Smoothed* cardiovascular disease mortality rates, by race, Montana, 1990-2005

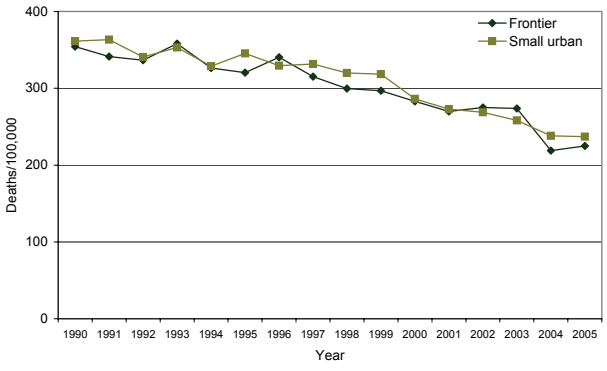


*3-year moving average (i.e., smoothed rate shown for 1991 is an average of 1990, 1991 and 1992)
Data source: Montana DPHHS, Office of Vital Statistics

MORTALITY

♥Age-adjusted CVD mortality rates were similar in frontier and small urban counties in the past 15 years, and age-adjusted rates declined steadily in both settings from 1990 through 2005. (Figure 8)

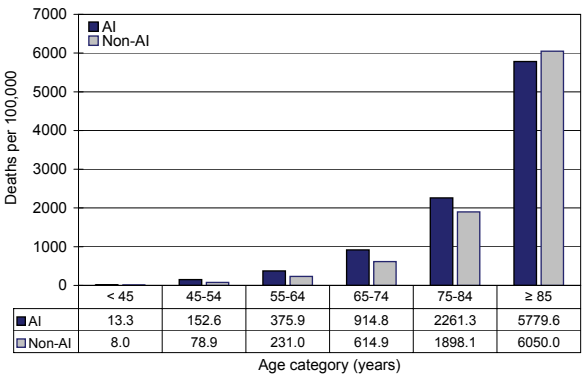
Figure 8. Age-adjusted cardiovascular disease mortality rates for Montana, by type of county, 1990-2005



Data source: Montana DPHHS, Office of Vital Statistics

♥During the time period 2000-2005, CVD mortality rates in American Indians less than 85 years of age exceeded the rates in non-Indians. Among the very elderly 85 years of age or more, the CVD mortality rate for non-Indians was slightly higher in the years 2000-2005. (Figure 9)

Figure 9. Cardiovascular disease mortality rates, by age and race, Montana, 2000-2005



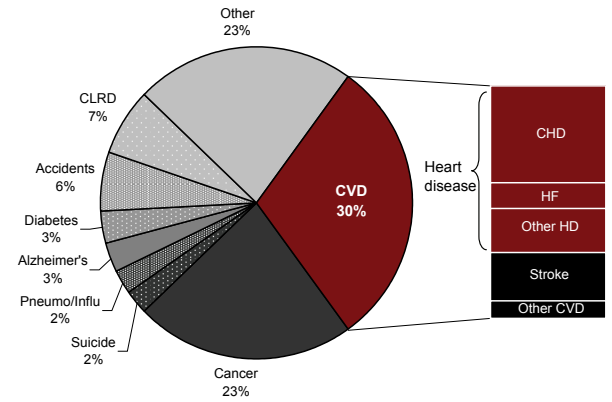
	< 45	45-54	55-64	65-74	75-84	≥ 85
AI	13.3	152.6	375.9	914.8	2261.3	5779.6
Non-AI	8.0	78.9	231.0	614.9	1898.1	6050.0

Data source: Montana DPHHS, Office of Vital Statistics

HEART DISEASE

In 2005, approximately 22% of all deaths in Montana were caused by heart disease. Heart disease includes coronary heart disease, heart failure and other types of heart disease. Although the deaths from heart disease were primarily from coronary heart disease, 285 of the heart disease deaths were attributed to heart failure. (Figure 10)

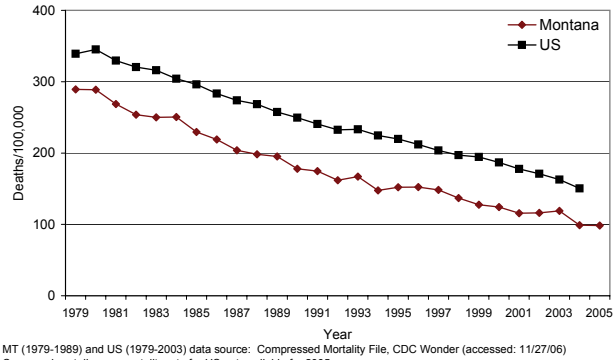
Figure 10. Leading causes of death, Montana, 2005



Data source: Montana DPHHS, Office of Vital Statistics, 2005

♥Coronary heart disease age-adjusted mortality rates in the US have exceeded the rates for Montana since 1979. Age-adjusted CHD mortality rates have decreased steadily over the past 26-year period in both Montana (66% decrease) and the US (50% decrease). (Figure 12)

Figure 12. Age-adjusted coronary heart disease mortality rates for Montana and the general US population, 1979-2005

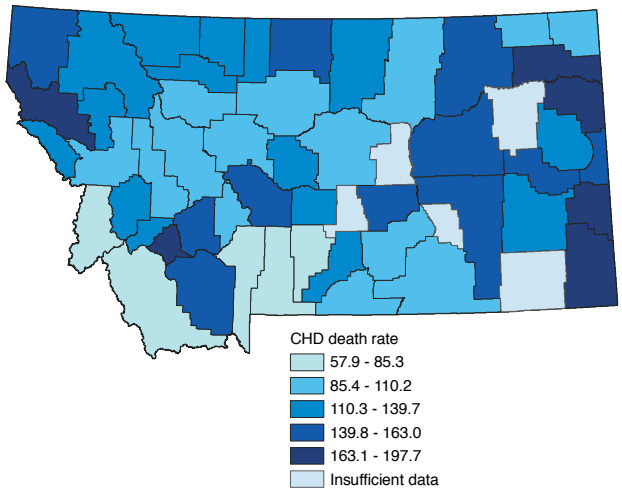


MT (1979-1989) and US (1979-2003) data source: Compressed Mortality File, CDC Wonder (accessed: 11/27/06)
Coronary heart disease mortality rate for US not available for 2005
MT (1990-2005) data source: Montana DPHHS, Vital Statistics

Coronary Heart Disease

Montana counties with the highest age-adjusted coronary heart disease mortality rates were located on the eastern part of the state. (Figure 11)

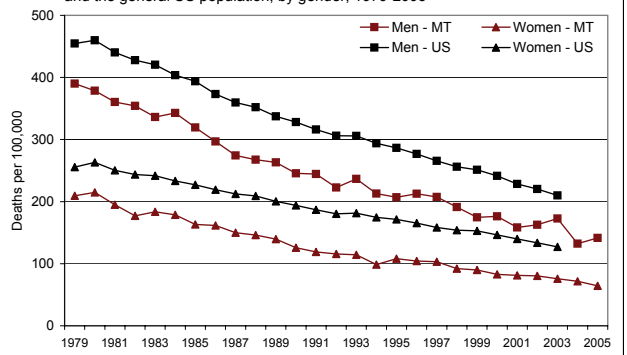
Figure 11. Age-adjusted coronary heart disease death rates, by county, Montana, 1999 - 2005



Data source:
Montana Department of Public Health and Human Services, Office of Vital Statistics

♥The age-adjusted coronary heart disease mortality rates have declined for Montana and US men and women. The decline of coronary heart disease has been more rapid for men compared to women However, the coronary heart disease mortality rates have remained higher in both US men and women compared to rates in Montana men and women. (Figure 13)

Figure 13. Age-adjusted coronary heart disease mortality rates for Montana and the general US population, by gender, 1979-2005

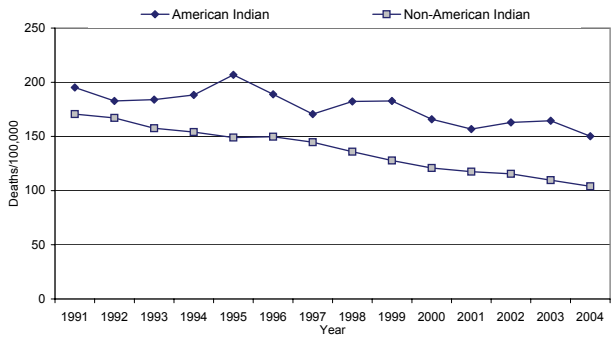


MT (1979-1989) and US (1979-2003) data source: Compressed Mortality File, CDC Wonder (accessed: 1/22/07)
Coronary heart disease mortality rate for US men and women not available for 2004 and 2005
MT (1990-2005) data source: Montana DPHHS, Vital Statistics

MORTALITY

- Age-adjusted coronary heart disease mortality in American Indians in Montana exceeded the rates for non-Indians by almost 45% in recent years (2003 – 2005). Death rates from coronary heart disease have decreased in recent years in both American Indians and non-Indians in Montana. (Figure 14)

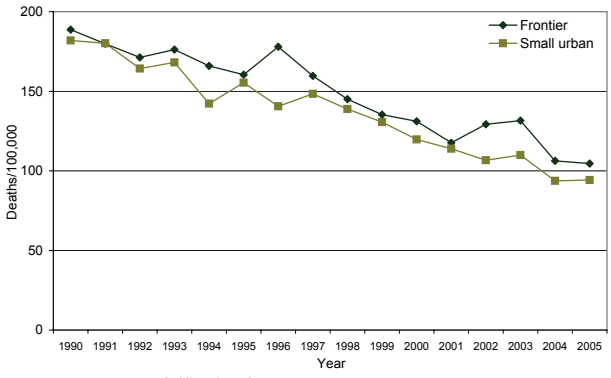
Figure 14. Smoothed* coronary heart disease mortality rates, by race, Montana, 1990-2005



*3-year moving average (i.e., smoothed rate shown for 1991 is an average of 1990, 1991 and 1992)
Data source: Montana DPHHS, Office of Vital Statistics

- The coronary heart disease age-adjusted mortality rates in small urban and frontier counties were similar in recent years and declined steadily from 1990 to the present. (Figure 15)

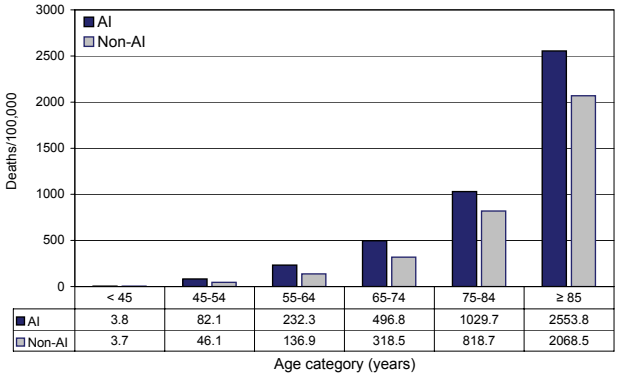
Figure 15. Age-adjusted coronary heart disease mortality rates for Montana, by type of county, 1990-2005



Data source: Montana DPHHS, Office of Vital Statistics

- In all age groups including the very elderly, the death rates from coronary heart disease in American Indians exceeded the death rates in the non-Indian population in Montana. (Figure 16)

Figure 16. Coronary heart disease mortality rates, by age and race, Montana, 2000-2005



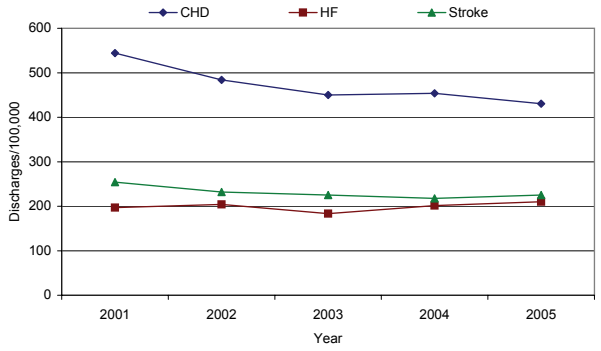
	< 45	45-54	55-64	65-74	75-84	≥ 85
AI	3.8	82.1	232.3	496.8	1029.7	2553.8
Non-AI	3.7	46.1	136.9	318.5	818.7	2068.5

Data source: Montana DPHHS, Office of Vital Statistics

Discharge Data

♥Age-adjusted hospital discharge rates for coronary heart disease in Montana decreased from 544 per 100,000 in 2001 to 430 per 100,000 in 2005. (Figure 17)

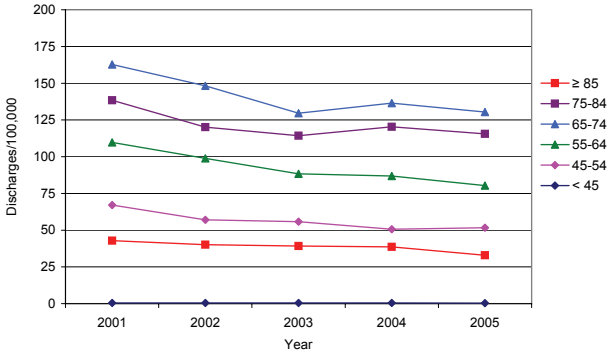
Figure 17. Age-adjusted cardiovascular disease hospital discharge rates, by type, Montana, 2001-2005



Data source: MHA - An Association of Montana Health Care Providers

♥In Montana, age-specific coronary heart disease hospital discharge rates decreased in all age groups from 2001 to 2005. (Figure 18) During the same time period, hospital discharge rates were highest among those 65 – 74 years old and lowest among those less than 45 and those 85 years and older.

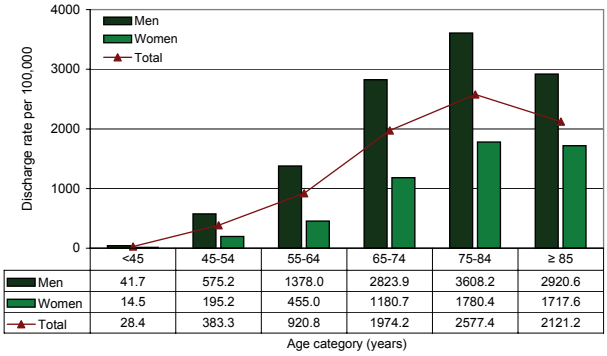
Figure 18. Age-specific coronary heart disease hospital discharge rates, Montana, 2001-2005



Data source: MHA - An Association of Montana Health Care Providers

♥In 2005, coronary heart disease hospital discharge rates in Montana increased with increasing age until the 75-84 age group and then declined somewhat in those 85 years and older. (Figure 19) In all age groups, CHD hospital discharge rates were higher in men compared to women in 2005.

Figure 19. Coronary heart disease hospital discharge rates, by gender and age, Montana, 2005



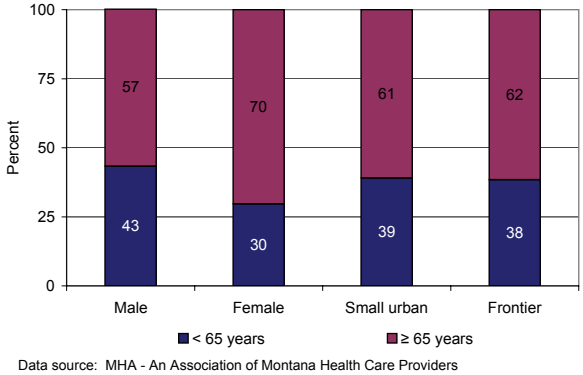
	<45	45-54	55-64	65-74	75-84	≥ 85
Men	41.7	575.2	1378.0	2823.9	3608.2	2920.6
Women	14.5	195.2	455.0	1180.7	1780.4	1717.6
Total	28.4	383.3	920.8	1974.2	2577.4	2121.2

Data source: MHA - An Association of Montana Health Care Providers

♥Over 43% of coronary heart disease hospital discharge rates in Montana men occurred in those younger than 65 years of age. (Figure 20)

♥There was no difference in the proportion of premature (< 65 years of age) coronary heart disease hospitalizations in urban county residents compared to those residing in frontier counties (39% vs. 38%). (Figure 20)

Figure 20. Percentage of premature (less than 65 years) coronary heart disease hospital discharges, by gender and type of county, Montana, 2005.



Data source: MHA - An Association of Montana Health Care Providers

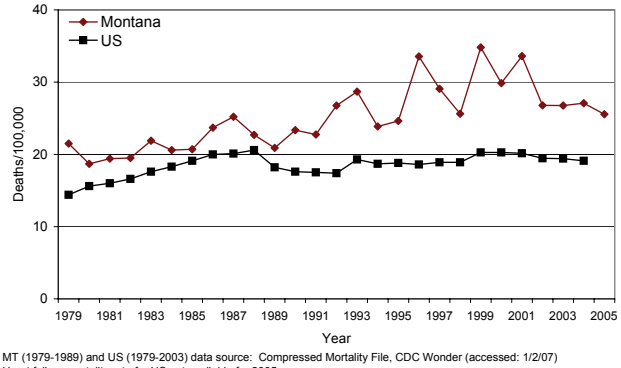
Heart Failure

The percentage of heart disease deaths attributed to heart failure remained relatively constant from 15% in 2000 to 16% in 2005.

♥From 1979 to 2005, the age-adjusted heart failure mortality rates for Montana exceeded the rates for the general US population and the difference in mortality rates between Montana and the US increased after 1989. (Figure 21)

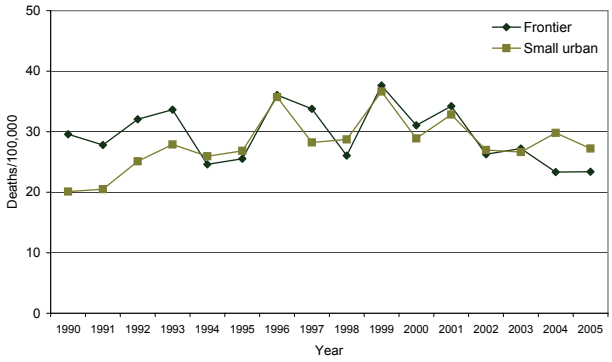
♥The age-adjusted heart failure mortality rates in frontier counties were higher than in small urban counties from 1990 to 1994, although during the next 10 years, the rates were essentially the same. In 2004 and 2005, age-adjusted heart failure mortality rates in small urban counties exceeded those in frontier counties. (Figure 23)

Figure 21. Age-adjusted heart failure mortality rates for Montana and the general US population, 1979-2005



MT (1979-1989) and US (1979-2003) data source: Compressed Mortality File, CDC Wonder (accessed: 1/2/07)
Heart failure mortality rate for US not available for 2005
MT (1990-2005) data source: Montana DPHHS, Vital Statistics

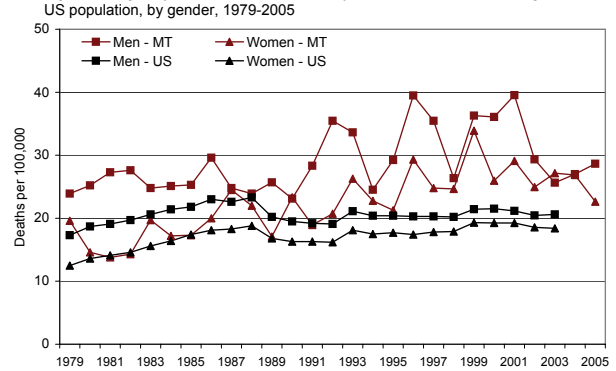
Figure 23. Age-adjusted heart failure mortality rates for Montana, by type of county, 1990-2005



Data source: Montana DPHHS, Office of Vital Statistics

♥From 1979 to 2005, although heart failure mortality rates fluctuated for Montana's men and women population, the overall age-adjusted heart failure mortality rates increased more rapidly compared to US men and women, respectively. Additionally, after 1991, the age-adjusted heart failure rates for Montana's men and women remained higher than both the US men and women population. (Figure 22)

Figure 22. Age-adjusted heart failure mortality rates for Montana and the general US population, by gender, 1979-2005

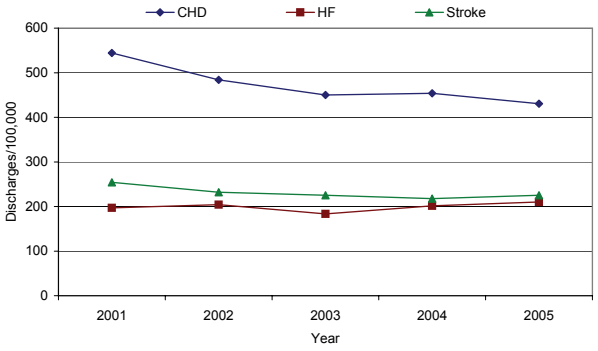


MT (1979-1989) and US (1979-2003) data source: Compressed Mortality File, CDC Wonder (accessed: 11/27/06)
Coronary heart disease mortality rate for US men and women not available for 2004 and 2005
MT (1990-2005) data source: Montana DPHHS, Vital Statistics

Discharge Data

♥Age-adjusted hospital discharge rates for heart failure in Montana increased slightly from 197 per 100,000 in 2001 to 210 per 100,000 in 2005. (Figure 17)

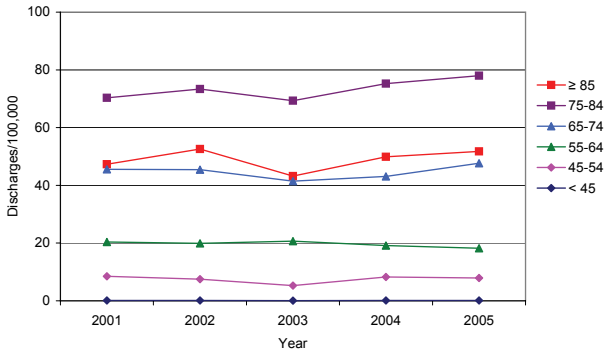
Figure 17. Age-adjusted cardiovascular disease hospital discharge rates, by type, Montana, 2001-2005



Data source: MHA - An Association of Montana Health Care Providers

♥From 2001 to 2005, age-specific heart failure hospital discharge rates increased in all age groups except in those 55-64 years of age. (Figure 24)

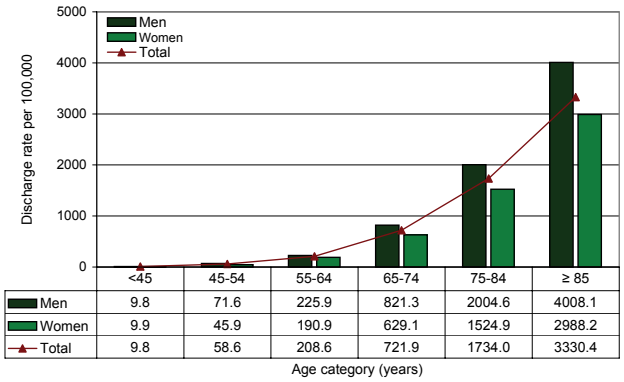
Figure 24. Age-specific heart failure hospital discharge rates, Montana, 2001-2005



Data source: MHA - An Association of Montana Health Care Providers

♥In 2005, Montana heart failure hospital discharge rates increased with increasing age, and discharge rates were higher in men compared to women in all age categories. (Figure 25)

Figure 25. Heart failure hospital discharge rates, by gender and age, Montana, 2005



	<45	45-54	55-64	65-74	75-84	≥ 85
Men	9.8	71.6	225.9	821.3	2004.6	4008.1
Women	9.9	45.9	190.9	629.1	1524.9	2988.2
Total	9.8	58.6	208.6	721.9	1734.0	3330.4

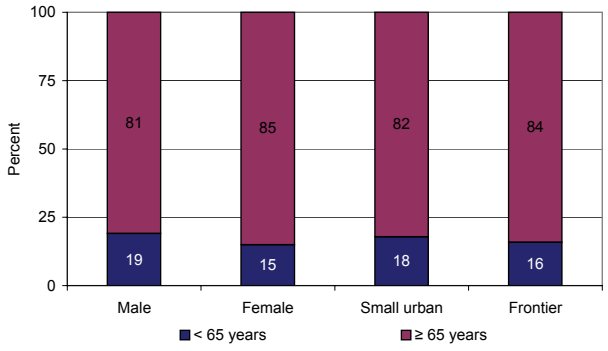
Age category (years)

Data source: MHA - An Association of Montana Health Care Providers

♥Of the heart failure hospital discharges in Montana, almost 20% of the discharges for men occurred in those younger than 65 years of age. For women, 15% of the heart failure discharges occurred in those younger than 65 years of age. (Figure 26)

♥The proportion of premature (< 65 years) heart failure hospital discharges in urban counties was slightly higher compared to frontier counties (18% vs. 16%). (Figure 26)

Figure 26. Percentage of premature (less than 65 years) heart failure hospital discharges in Montana, by gender and type of county, 2005.

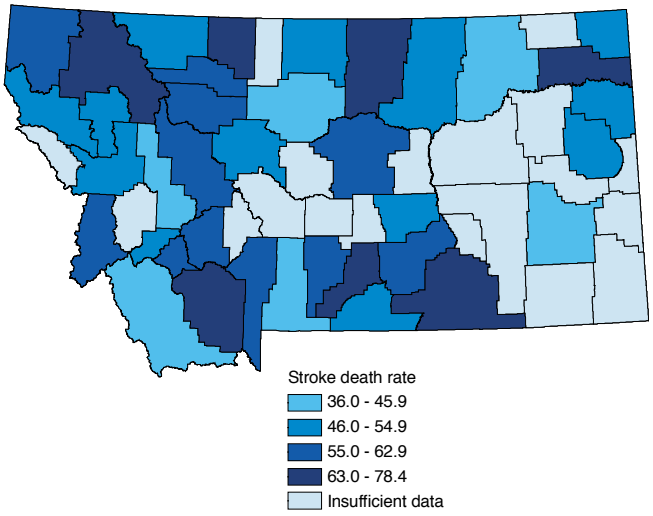


Data source: MHA - An Association of Montana Health Care Providers

STROKE

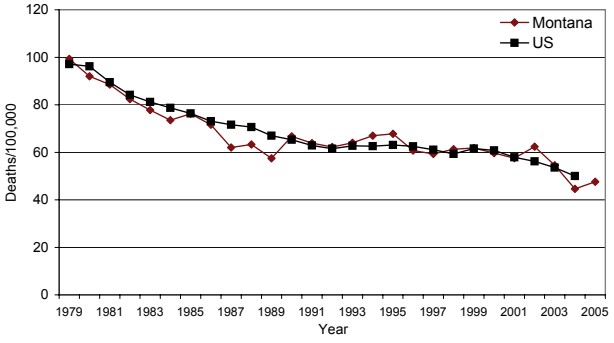
A map of age-adjusted stroke mortality rates from 1999 to 2005 illustrates those counties with the highest mortality rates are scattered throughout Montana. (Figure 27)

Figure 27. Age-adjusted stroke death rate, by county, Montana, 1999-2005



♥Age-adjusted stroke mortality rates in Montana and the US were similar, and the rates have decreased by about 50% in both populations over the past 26 years. (Figure 29)

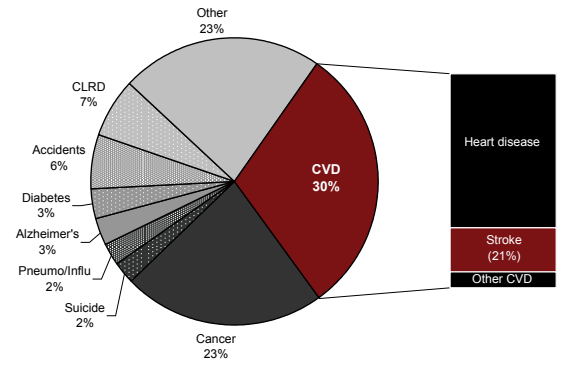
Figure 29. Age-adjusted stroke mortality rates for Montana and the general US population, 1979-2005



MT (1979-1989) and US (1979-2003) data source: Compressed Mortality File, CDC Wonder (accessed: 11/27/06)
Stroke mortality rate for US not available for 2005
MT (1990-2005) data source: Montana DPHHS, Vital Statistics

In 2005, approximately six percent of all deaths in Montana were attributed to stroke. (Figure 28)

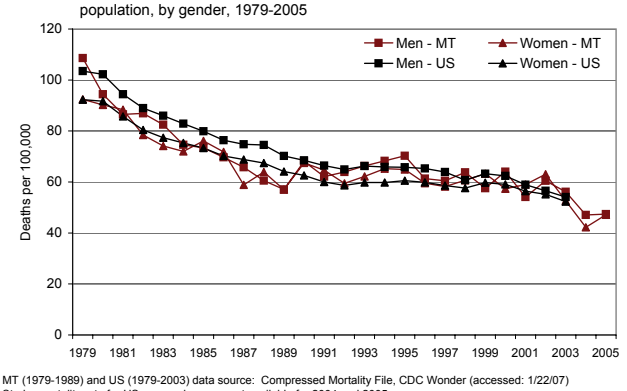
Figure 28. Leading causes of death, Montana, 2005



Data source: Montana DPHHS, Office of Vital Statistics, 2005

♥For Montana and the US, the overall age-adjusted stroke mortality rates have declined in men and women from 1979 to 2005. The rate of decline has been less rapid for men and women in Montana than for those in US. (Figure 30)

Figure 30. Age-adjusted stroke mortality rates for Montana and the general US population, by gender, 1979-2005

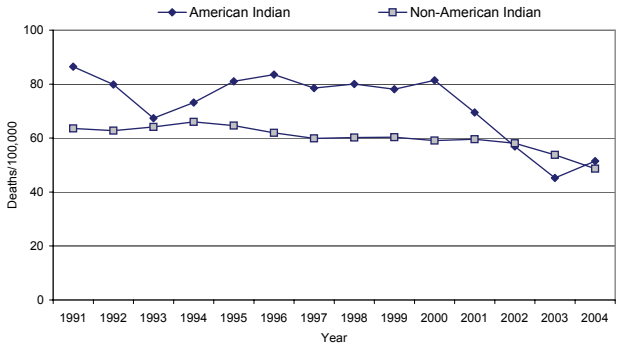


MT (1979-1989) and US (1979-2003) data source: Compressed Mortality File, CDC Wonder (accessed: 1/22/07)
Stroke mortality rate for US men and women not available for 2004 and 2005
MT (1990-2005) data source: Montana DPHHS, Vital Statistics

- Age-adjusted stroke mortality rates in American Indians exceeded the rates in non-Indians until 2002 when rates became similar. (Figure 31)

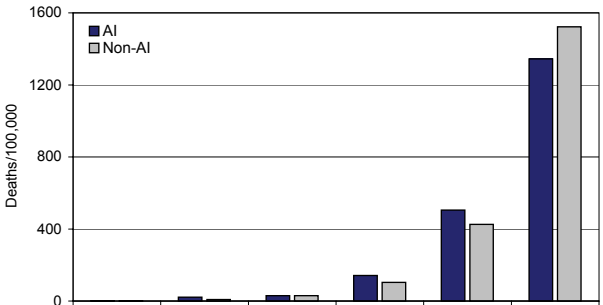
- In the most recent six-year time period (2000-2005), the stroke mortality rate was higher in American Indians compared to non-Indians in all age groups except those aged 85 years and older. (Figure 33)

Figure 31. Smoothed* stroke mortality rates, by race, Montana, 1990-2005



*3-year moving average (i.e., smoothed rate shown for 1991 is an average of 1990, 1991 and 1992)
Data source: Montana DPHHS, Office of Vital Statistics

Figure 33. Stroke mortality rates, by age and race, Montana, 2000-2005



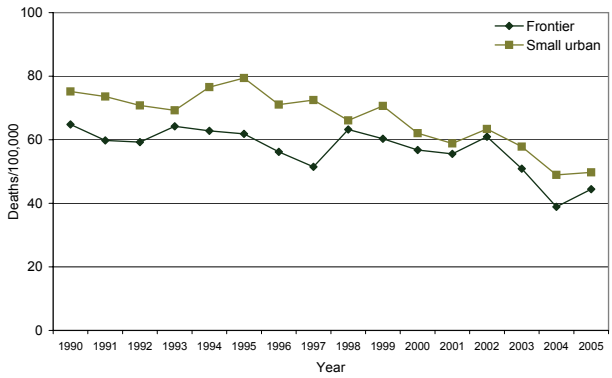
	< 45	45-54	55-64	65-74	75-84	≥ 85
AI	2.1	21.1	29.6	142.0	504.7	1344.1
Non-AI	1.0	8.0	29.4	103.7	425.9	1522.1

Age category (years)

Data source: Montana DPHHS, Office of Vital Statistics

- From 1990 to 2005, age-adjusted stroke mortality rates in small urban counties exceeded those in frontier counties and decreased in both populations. (Figure 32)

Figure 32. Age-adjusted stroke mortality rates for Montana, by type of county, 1990-2005

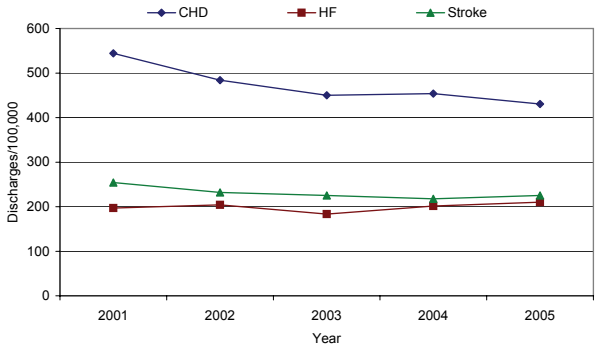


Data source: Montana DPHHS, Office of Vital Statistics

Discharge Data

- Among Montana residents, age-adjusted stroke hospital discharge rates decreased slightly from 254 per 100,000 in 2001 to 225 per 100,000 in 2005. (Figure 17)

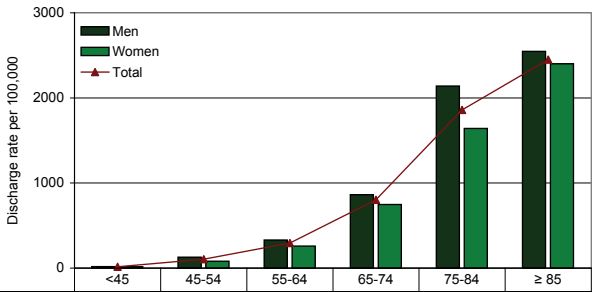
Figure 17. Age-adjusted cardiovascular disease hospital discharge rates, by type, Montana, 2001-2005



Data source: MHA - An Association of Montana Health Care Providers

- Stroke hospital discharge rates in Montana increased with advancing age and were higher in men compared to women in 2005. (Figure 35)

Figure 35. Stroke hospital discharge rates, by gender and age, Montana, 2005



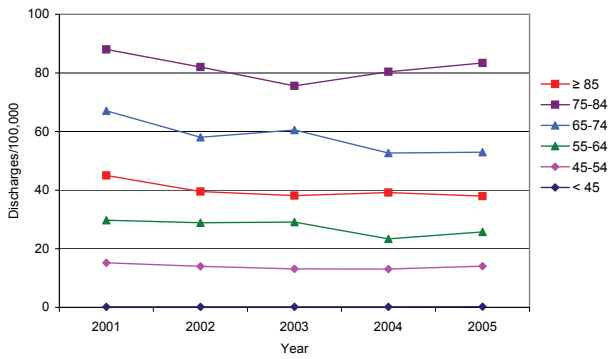
	<45	45-54	55-64	65-74	75-84	≥ 85
Men	17.4	128.8	330.9	861.3	2140.0	2547.8
Women	14.8	80.4	258.7	746.9	1642.2	2400.0
Total	16.2	104.4	295.2	802.2	1859.2	2449.6

Age category (years)

Data source: MHA - An Association of Montana Health Care Providers

- Montana age-specific stroke discharge rates decreased in all age categories and were highest in those 75-84 years of age. (Figure 34)

Figure 34. Age-specific stroke hospital discharge rates, Montana, 2001-2005



Data source: MHA - An Association of Montana Health Care Providers

- More stroke hospitalizations occurred in small urban county residents compared to frontier county residents, and the percentage in small urban county residents increased from 2000 to 2005. (Data not shown)

MODIFIABLE CARDIOVASCULAR RISK FACTORS

The American Heart Association has identified several risk factors for cardiovascular disease. Among those are "modifiable" risk factors – those factors that can be controlled through lifestyle changes and/or medications (i.e., diabetes, elevated blood pressure, high blood cholesterol, obesity, smoking and sedentary life style) and "non-modifiable" risk factors that include age, gender, and heredity.

To compare Montana status to the Healthy People 2010 goals for the US (5), we identified individual objectives that correspond to information in the BRFSS and compared them to the actual status of Montanans according to BRFSS in 2005 (4,6). When possible, trend analyses are also presented from 1990-2005. (Table 1)

Table 1.
Montana's Cardiovascular Disease/Healthy People (HP) 2010 objectives and 2005 BRFSS prevalence for Montana and Montana American Indians

	HP 2010	MONTANA	
Montana's CVD/Healthy People 2010 Objectives	**Target (%)**	**BRFSS (%)**	**AI adapted BRFSS**
(5-3) Reduce overall cases (per 100 population) of diabetes that is clinically diagnosed	≤ 2.5	5.7	18.7
(12-9) Reduce the proportion of adults with high blood pressure	≤ 16	24.0	37.4
(12-11) Increase the proportion of people with high blood pressure who are taking action to help control their blood pressure	≥ 95	95.4	Not available
(12-14) Reduce the proportion of adults with high total blood cholesterol	≤ 17	33.4	35.5
(12-15) Increase the proportion of adults who have had their blood cholesterol checked within the preceding five years	≥ 80	68.6	70.0
(27-1) Reduce cigarette smoking by adults	≤ 12	19.2	39.5
(19-2) Reduce the proportion of adults who are obese (BMI* > 30.0 kg/m^2)	≤ 15	21.3	37.7

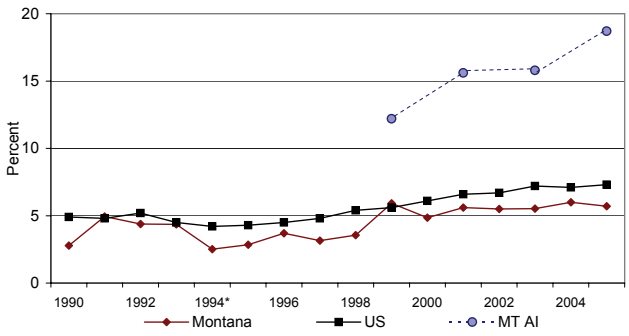
*Body Mass Index
AI–American Indian

DIABETES

The prevalence of diabetes reported by adults in Montana increased steadily from 1990 to 2001. From 2001 to 2005, the prevalence of self-reported diabetes remained relatively constant at almost 6% for Montana adults. Among Montana's adult Indian population, the prevalence of diabetes increased significantly from 12% in 1999 to 19% in 2005. (Figure 36)

- For adult Montanans, there was a three-percentage point increase in prevalence of self-reported diabetes from 3% in 1990 to 6% in 2005.
- Montana's Indian adults reported diabetes twice as frequently as all Montanans in 1999 and over three times more frequently in 2005.

Figure 36. Prevalence of diabetes for all Montanans, Montana American Indians and the US, 1990 to 2005



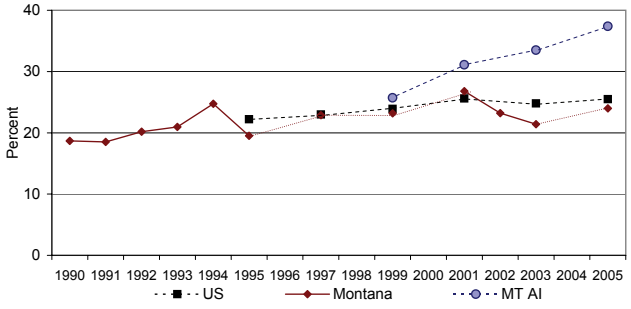
Data source: Montana BRFSS, Montana DPHHS, Health Planning Section, 1990-2005.
Montana American Indian adapted-BRFSS, Montana DPHHS, 1999, 2001, 2003 and 2005.
*Question changed in 1994 to exclude females with gestational diabetes.

HIGH BLOOD PRESSURE

Almost a quarter (24%) of all Montana adults reported a history of high blood pressure in 2005, a prevalence that had increased from 19% in 1990. The prevalence of high blood pressure for the US remained relatively constant at approximately 25% of adults over the past 10 years. From 1999 to 2005, the prevalence of high blood pressure among American Indian adults in Montana increased significantly from 26% in 1999 to 37% in 2005. (Figure 37)

- In 1999, there was only a 2.5-percentage point difference in the prevalence of high blood pressure between Indian and Montana adults (26% vs. 23%). However by 2005, the difference in prevalence of high blood pressure between Indian and other Montana adults had increased dramatically. In that year, American Indian adults reported a prevalence half again higher than that in other Montana adults (37% vs. 24%).

Figure 37. Prevalence of high blood pressure for all Montanans, Montana American Indians and the US, 1990 to 2005



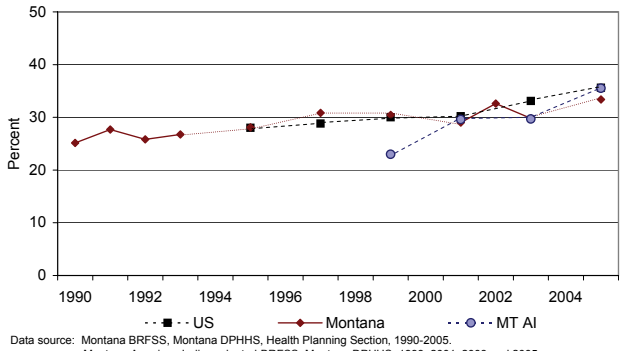
Data source: Montana BRFSS, Montana DPHHS, Health Planning Section, 1990-2005.
Montana American Indian adapted-BRFSS, Montana DPHHS, 1999, 2001, 2003 and 2005
Blood pressure questions not asked in 1996, 1998, 2000 and 2004 for Montana.
Blood pressure questions not asked in 1990-1994, 1996, 1998, 2000, 2002 and 2004 for the US.

HIGH BLOOD CHOLESTEROL

Over the past decade, both the prevalence and the slight increase in prevalence of high blood cholesterol, among all Montana adults and the US adult population, have been similar. From 1990 to 2005, there was a significant increase in the prevalence of high blood cholesterol among Montana American Indian adults. (Figure 38)

- Over the past 16 years, the prevalence of high blood cholesterol among Montana adults increased from 25% to 33%.
- Among the US adult population over the past decade (1995-2005), the prevalence of high blood cholesterol increased from 28% to 36%.
- Among American Indian adults, there was over a 10-percentage point increase in self-reported high blood cholesterol from 23% in 1999 to 36% in 2005.

Figure 38. Prevalence of high blood cholesterol for all Montanans, Montana American Indians and the US, 1990 to 2005



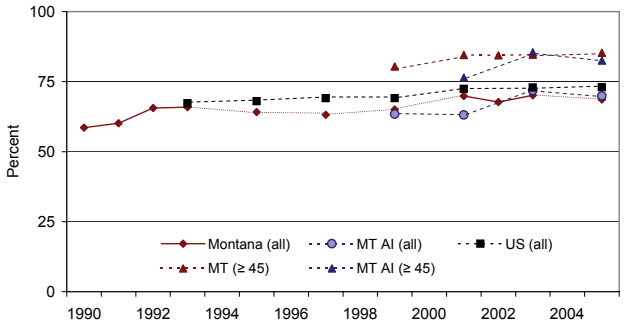
Data source: Montana BRFSS, Montana DPHHS, Health Planning Section, 1990-2005.
Montana American Indian adapted-BRFSS, Montana DPHHS, 1999, 2001, 2003 and 2005.
High cholesterol questions not asked in 1994, 1996, 1998, 2000, 2002 and 2004 for Montana.
High cholesterol questions not asked in 1990-1994, 1996, 1998, 2000, 2002 and 2004 for the US.

BLOOD CHOLESTEROL SCREENING

In the general US population, the percentage of adults who reported having their blood cholesterol checked in the past five years increased from 67% in 1993 to 73% in 2005 and remained higher than the percentages in Montana adults (59% in 1990 to 69% in 2005). However, in Montana American Indians, there was also an increase in the percentage of adults who reported having their blood cholesterol checked in the past five years from 63% in 1999 to 70% in 2005. (Figure 39)

Among Montana adults 45 years and older, between 80% and 85% reported having their blood cholesterol checked in the past five years from 1999 to 2005. During the same time period, Montana American Indians 45 years and older who reported having their blood cholesterol checked in the past year increased from 76% in 2001 to 83% in 2005. (Figure 39)

Figure 39. Prevalence of cholesterol screening (in past 5 years) for all Montanans, Montana American Indians and the US, overall and for those 45 years and older, 1990 to 2005



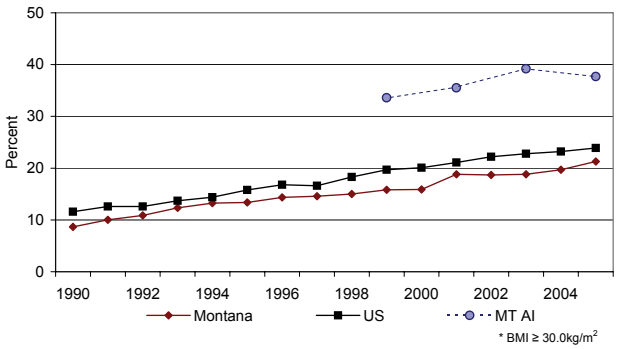
Data source: Montana BRFSS, Montana DPHHS, Health Planning Section, 1990-2005.
Montana American Indian adapted-BRFSS, Montana DPHHS, 1999, 2001, 2003 and 2005.

OBESITY

The prevalence of obesity increased among both Montana and US adults from 1990 to 2005. The US obesity prevalence continued to be slightly higher compared to that of all Montanans. Among Montana Indian adults from 1999 to 2005, the prevalence of obesity continued to be almost twice that of all Montanans and the US adult population. (Figure 40)

- Over the past 16 years, the prevalence of obesity in Montana adults has doubled from 9% to 21%. In 2005, one out of five Montana adults was obese.
- Similarly, from 1990 to 2005, the prevalence of obesity in the US has increased from 12% to 24%.
- Over the seven-year time period 1999 to 2005, the prevalence of obesity for Montana Indian adults has increased from 34% to 38%.

Figure 40. Prevalence of obesity* for all Montanans, Montana American Indians and the US, 1990 to 2005



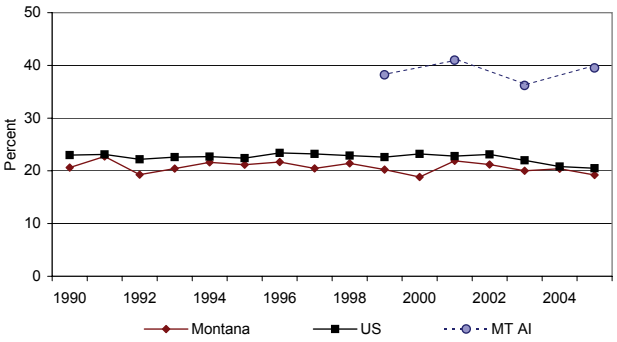
Data source: Montana BRFSS, Montana DPHHS, Health Planning Section, 1990-2005.
Montana American Indian adapted-BRFSS, Montana DPHHS, 1999, 2001, 2003 and 2005.

CURRENT TOBACCO USE

Adults in Montana reported current tobacco use at a slightly lower prevalence than adults in the US. Among Montana Indian adults, the prevalence of current tobacco use remained unchanged albeit two times higher than that of all Montana and US adults. (Figure 41)

- From 1990 to 2005 among US adults, the prevalence of tobacco use decreased slightly from 23% in 1990 to 21% in 2005.
- During this time-period in Montana, current tobacco use remained relatively constant at approximately 20%.
- During the same time-period, approximately two out of five Montana Indian adults reported currently using tobacco.

Figure 41. Prevalence of current tobacco use for all Montanans, Montana American Indians and the US, 1990 to 2005



Data source: Montana BRFSS, Montana DPHHS, Health Planning Section, 1990-2005.
Montana American Indian adapted-BRFSS, Montana DPHHS, 1999, 2001, 2003 and 2005.
Tobacco questions asked only in 1999, 2001, 2003 and 2005 for Montana American Indians.

HEART ATTACK

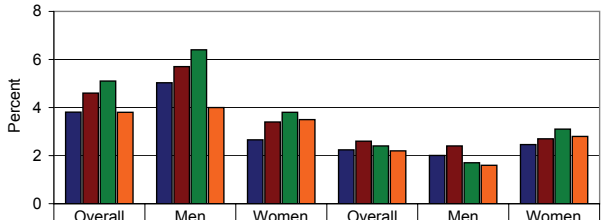
The percentage of adult Montanans who reported having experienced a heart attack increased from 3.8% in 1999 to 5.1% in 2003 and then declined to 3.8% in 2005. (Figure 42)

- Among all Montanans, men were almost two times more likely to report a history of heart attack compared to women. (Figure 42)
- The percentage of adults who self-reported having had a heart attack increased with increasing age. (Data not shown)
- Over time, the prevalence of self-reported heart attack increased slightly in respondents 45 to 64 years of age, from 2.9% in 1999 to 4.1% in 2005 with a high of 6.1% in 2001. (Data not shown)

The prevalence of American Indian adults who reported a heart attack increased slightly from 5.6% in 1999 to 6.8% in 2005. (Figure 43) In addition, the prevalence of heart attack among Montana American Indians was double that of all Montanans from 1999 to 2005.

- Montana American Indian men were two times more likely to report having had a heart attack compared to Montana American Indian women.

Figure 42. Prevalence of Montana adults who reported having a heart attack or stroke, by gender, 1999 to 2005



	Heart Attack			Stroke		
	Overall	Men	Women	Overall	Men	Women
1999	3.8	5.0	2.7	2.2	2.0	2.5
2001	4.6	5.7	3.4	2.6	2.4	2.7
2003	5.1	6.4	3.8	2.4	1.7	3.1
2005	3.8	4.0	3.5	2.2	1.6	2.8

Source data: Montana BRFSS, Montana DPHHS, Health Planning Section, 1999 - 2005.

STROKE

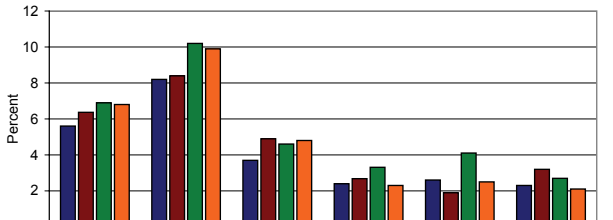
From 1999 to 2005, the overall prevalence of ever having a stroke reported among adult Montanans remained relatively unchanged at 2%. (Figure 42)

- The percentage of adult Montanans who reported having experienced a stroke increased with increasing age. (Data not shown)
- Among all Montana adults, women were more likely than men to report having had a stroke. From 1999 to 2003, the change in prevalence of self-reported stroke increased slightly for women but decreased slightly for men. (Figure 42)

Although the number of strokes reported among Montana American Indians was less than 50 for each year, the overall prevalence of stroke increased from 2.4% to 3.3% from 1999 to 2003 and then declined to 2.3% in 2005. (Figure 43)

- There was no difference in self-reported stroke between American Indian men and women during this time-period.

Figure 43. Prevalence of Montana American Indian adults who reported having a heart attack or stroke, by gender, 1999 to 2005



	Heart Attack			Stroke		
	Overall	Men	Women	Overall	Men	Women
1999	5.6	8.2	3.7	2.4	2.6	2.3
2001	6.4	8.4	4.9	2.7	1.9	3.2
2003	6.9	10.2	4.6	3.3	4.1	2.7
2005	6.8	9.9	4.8	2.3	2.5	2.1

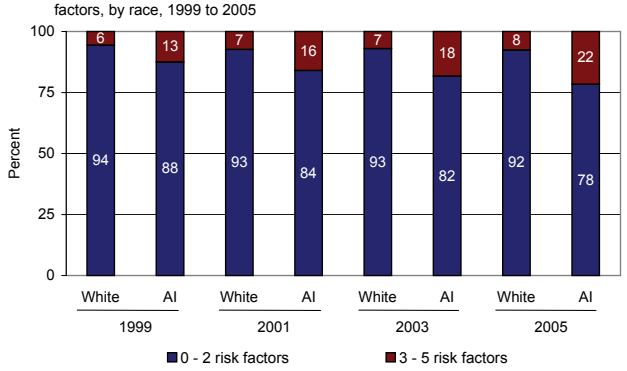
Source data: Montana BRFSS, Montana DPHHS, Health Planning Section, 1999 - 2005.

NUMBER OF CARDIOVASCULAR RISK FACTORS

Montana Indian adults were more likely than white adults to report three or more cardiovascular risk factors. The excess in the percentage of three or more cardiovascular risk factors reported by Indian adults increased from two times higher than that for white adults (6% vs. 13%) in 1999 to almost four times higher in 2005 (8% vs. 22%). (Figure 44)

- The percentage of white Montana adults reporting three or more cardiovascular risk factors increased slightly from 6% in 1999 to 8% in 2005.
- Among Montana American Indian adults, the percentage of adults reporting three or more cardiovascular risk factors almost doubled from 13% in 1999 to 22% in 2005.

Figure 44. Prevalence of Montana adults with self-reported cardiovascular risk factors, by race, 1999 to 2005



Data source: Montana BRFSS, Montana DPHHS, Health Planning Section, 1999-2005.
Montana American Indian adapted-BRFSS, Montana DPHHS, 1999, 2001, 2003 and 2005

KNOWLEDGE OF HEART ATTACK AND STROKE SIGNS/ SYMPTOMS AND NEED TO CALL 9-1-1

HEART ATTACK SIGNS AND SYMPTOMS

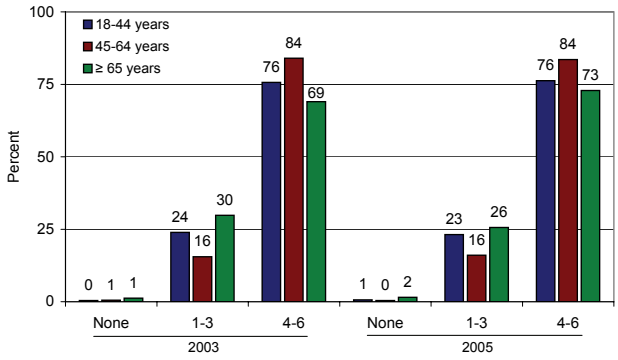
Overall, among those who responded to all six BRFSS heart attack signs and symptoms questions, the percentage who could identify four or more signs and symptoms correctly remained unchanged in respondents less than 65 years old from 2003 to 2005. (Figure 45) Among older respondents, there was a slight increase, although not significant, in knowledge of four or more heart attack signs and symptoms (69% to 73%) from 2003 to 2005. The percentage of adults who answered all six heart attack questions correctly remained essentially the same, 14% in 2003 to 15% in 2005. (Data not shown)

In 2005, over 80% of respondents 65 years and older were aware of heart attack symptoms chest pain or discomfort, arm or shoulder pain, and shortness of breath. (Figure 46) From 2003 to 2005, there were significant increases in the percentage who correctly identified “weak, lightheaded or faint” (50% to 59%) as heart attack signs or symptoms.

Silver Bow County Heart Attack Community Education Campaign

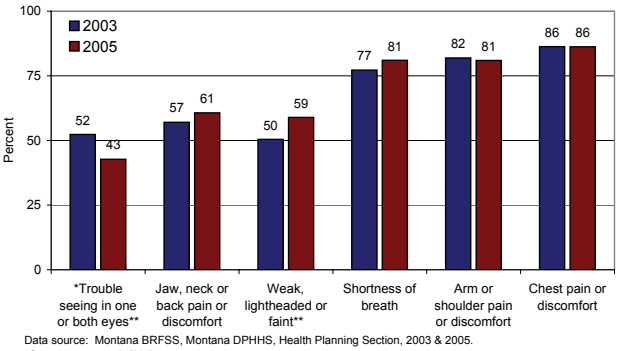
In 2005, the Montana Cardiovascular Health Program conducted a 20-week community awareness campaign to improve recognition of signs and symptoms of heart attack in Silver Bow County. After 30 weeks from baseline to follow-up, knowledge of three or more heart attack signs and symptoms increased significantly from 58% to 74% in adults 45 years and older who reside in Silver Bow County. (Figure 47)

Figure 45. Percentage responding correctly to questions about heart attack signs and symptoms among Montana adults, by age, 2003 and 2005



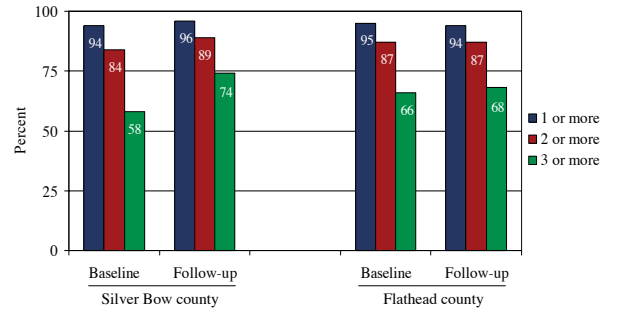
Source data: Montana BRFSS, Montana DPHHS, Health Planning Section, 2003 & 2005

Figure 46. Knowledge of heart attack signs and symptoms among Montana adults 65 years and older, 2003 and 2005



Data source: Montana BRFSS, Montana DPHHS, Health Planning Section, 2003 & 2005.
*Correct response is "No"
**P-value < 0.05

Figure 47. Knowledge of heart attack warning signs among adults 45 years and older in Silver Bow and Flathead counties at baseline and follow-up, 2005



KNOWLEDGE OF HEART ATTACK AND STROKE SIGNS/ SYMPTOMS AND NEED TO CALL 9-1-1

STROKE SIGNS AND SYMPTOMS

Overall, the percentage of those who would identify four or more stroke signs and symptoms correctly increased significantly from 75% to 79% among residents who responded to all six BRFSS stroke questions from 2003 to 2005. (Data not shown)

- Among respondents 65 years and older, the percentage correctly identifying four or more stroke signs and symptoms increased significantly from 66% in 2003 to 74% in 2005. (Figure 48)
- From 2003 to 2005, older respondents demonstrated significant improvement in their knowledge that severe headache with no known cause (49% to 58%), trouble seeing in one or both eyes (56% to 67%) and confusion or trouble speaking (80% to 85%) were signs or symptoms of stroke. (Figure 49)

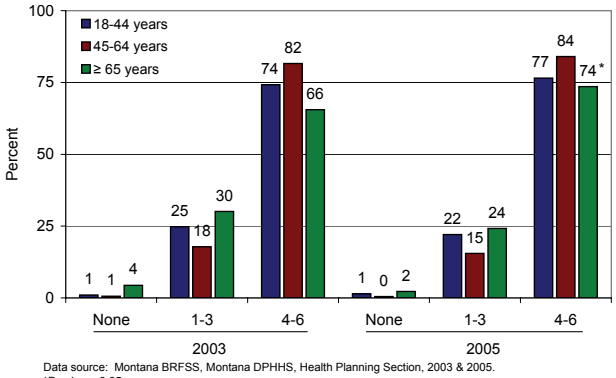
Cascade and Yellowstone County Stroke Community Education Campaigns

During 2004 and 2005, the Montana Cardiovascular Health Program conducted community awareness campaigns to improve recognition of signs and symptoms of stroke in Cascade and Yellowstone counties for 32 weeks and 20 weeks, respectively. During 2004, Yellowstone County was the comparison community. In both Cascade and Yellowstone counties, there was significant increase in stroke signs and symptoms knowledge from baseline in 2004 to follow-up in 2005. (Figure 50)

NEED TO CALL 9-1-1

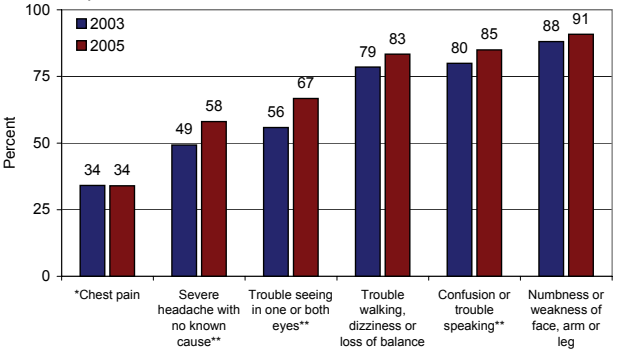
Approximately 84% of Montana adults reported that they would call 9-1-1 if they thought someone was having a heart attack or stroke, and this percentage has remained unchanged from 2003 to 2005. (Data not shown)

Figure 48. Percentage responding correctly to questions about stroke signs and symptoms among Montana adults, by age, 2003 and 2005



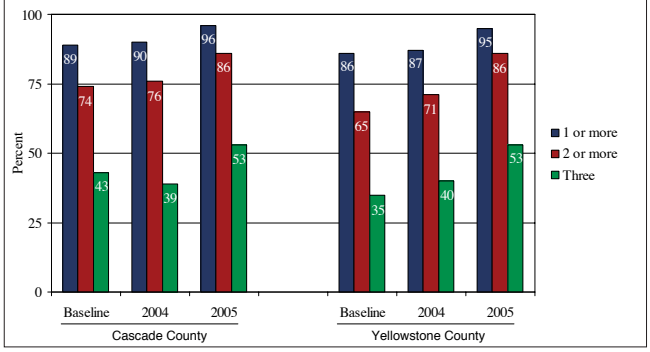
Data source: Montana BRFSS, Montana DPHHS, Health Planning Section, 2003 & 2005.
*P-value < 0.05

Figure 49. Knowledge of stroke signs and symptoms among Montana adults 65 years and older, 2003 and 2005



Data source: Montana BRFSS, Montana DPHHS, Health Planning Section, 2003 & 2005
*Correct response is "No"
**P-value < 0.05

Figure 50. Knowledge of stroke warning signs among adults 45 years and older in Cascade and Yellowstone counties at baseline and follow-up, 2004 and 2005



DISCUSSION AND CONCLUSION

Cardiovascular disease (including heart disease and stroke) continues to be the leading cause of death in Montana. Although cardiovascular disease mortality rates have declined for both the US and Montana over the past two decades, Montana's American Indian population continued to have higher cardiovascular disease death rates than non-Indians; little change in this disparity has occurred since 1990. Also of concern for Montana is the increase in mortality from heart failure compared to the US population, particularly in small urban counties.

Hospitalizations from cardiovascular events (i.e., coronary heart disease, heart failure and stroke) are not rare in Montana. In 2005, rates for coronary heart disease, heart failure and stroke hospital discharges remained higher in men than in women and among older residents. However, over 40% of residents hospitalized for coronary heart disease were less than 65 years of age. Overall in 2005, 4% of adults in Montana reported that they had ever had a heart attack and over 2% reported having ever had a stroke. In 2005, the disparate excess reported by American Indian adults was significant; 7% of Montana Indians and 4% of Montana adults reported a history of a heart attack.

From 1990 to 2005, modifiable cardiovascular risk factors were common in Montana. The prevalence of diabetes, high blood pressure, high cholesterol, and obesity have steadily increased, particularly among Montana's American Indian population. American Indian adults living on or near the seven reservations in Montana continued to report having diabetes, high blood pressure, smoking and being obese more often than other Montanans and the general US population over the past 16 years. In addition, high smoking rates remained unchanged for all Montanans and Montana American Indians over the same time-period. American Indian adults were more likely than whites to report three or more cardiovascular risk factors, and the difference reported was almost four times higher for American Indians in 2005.

Over 75% of Montana residents recognized most of the most common signs and symptoms of heart attack and stroke. However, older individuals were less likely than younger individuals to correctly identify signs and symptoms of heart attack or stroke. On the other hand, from 2003 to 2005, particularly among older individuals, knowledge of stroke signs and symptoms increased significantly. In counties with community heart attack or stroke awareness campaigns, there was an overall increase in the percentage of adults aged 45 years and older who correctly identified three or more signs or symptoms.

In summary, although the mortality related to CVD has decreased in Montana, there has been a steady increase in the prevalence of risk factors. Overall, although hospitalization rates have declined for coronary heart disease and stroke, there has been a slight increase in the rate for heart failure hospitalization. American Indians are at very high risk for cardiovascular disease with particularly high rates of diabetes, high blood pressure, obesity and cigarette smoking contributing to the risk. The number of American Indians in Montana reporting three or more risk factors almost doubled from 1999 to 2005. Thus, although mortality rates have decreased in Montana, striking disparities remain, and the clinical and public health challenges to reduce the burden of cardiovascular disease in coming years are substantial.

APPENDIX A – Methods, Data Sources and Limitations

MORTALITY:

All Montana cardiovascular disease deaths from 1990 through 2005 were identified through death record information collected by the Office of Vital Statistics (OVS), Montana Department of Public Health and Human Services. (7) Bureau of Census data were used for 1990 and 2000 population, and intercensal population estimates were used for 1991-1999 and 2001-2005. (8)

Beginning with mortality data for 1999, the Montana Office of Vital Statistics began reporting underlying causes of death information by ICD-10. Prior to 1999, underlying causes of death information were reported by ICD-9. Each new version of the ICD code introduces challenges with the development of comparable mortality data classified with different versions of the code. The National Center for Health Statistics (NCHS) attempts to quantify the effects of ICD revisions for each category of interest by calculating a ratio of the number of deaths classified in the latest version that classified in the previous version. "Comparability ratios" provide estimates of change attributed to the revision alone and help distinguish "coding changes" from "real changes." The comparability ratios, ICD-9 and ICD-10 codes used to define cardiovascular disease, heart disease, coronary heart disease, heart failure and cerebrovascular disease, are listed below. As comparability ratios are approximately one for each category, no further calculations were done.

Montana annual mortality rates were calculated from 1990 to 2005, and the rates were age-adjusted to the US 2000 standard population. US mortality data for 1979-2003 and Montana mortality data for 1979-1989 were obtained through the use of the National Center for Health Statistics (NCHS) website. (9) US mortality data for 2004 were obtained from the NCHS National Vital Statistics Report. (10) For Montana's American Indian population, an average annual direct age-adjusted (to the US 2000 standard population) rate was calculated for a moving 3-year period from 1990 to 2005. Age-adjusted mortality rates for Montana's small urban and frontier counties were calculated using Montana's county-specific populations from 1990-2005.

Definitions used for Montana's "small urban" and "frontier" counties were based on the five urbanization levels classification obtained from the Office of Management and Budget as used in Health, United States, 2001 with Urban and Rural Health Chartbook. (1) During the past two decades, Montana's total population did not exceed 1 million people; therefore, we combined small metropolitan counties (of which Montana has 2) and non-metropolitan counties with a city of 10,000 or more population (of which Montana has 6) into the category we defined as "small urban." The remaining 48 counties, defined as non-metropolitan counties without a city of 10,000 or more population we defined as "frontier." The terms "small urban" and "frontier" as used in this document are general descriptors only.

Cause of Death	ICD-9 Codes 1990 -1998	ICD-10 Codes 1999 – 2005	Comparability Ratio
Cardiovascular disease	390-448	I00 – I78	0.9981
Coronary heart disease	410-414, 429.2	I20 – I25	0.9990
Heart failure	428	I50	1.0410
Cerebrovascular disease	430-434, 436-438	I60 – I69	1.0588

Beginning in 2003, Montana OVS recorded biracial and multi-racial in the "Other Race" category. Informants were encouraged to "check one or more races to indicate what the decedent considered himself or herself to be." This change has resulted in a notable increase in the number of decedents with more than one race reported.

Limitations:

First, inconsistent and inaccurate race coding for American Indians in death records have been documented. (11) Such findings suggest death rates for Montana American Indians are underestimated overall. The findings also indicate that American

Indians who do not live on or near reservations are more likely to be misclassified as non-American Indians at the time of death. Therefore, current available mortality estimates for Montana American Indians who reside outside reservations may be systematically lower than the actual death rate for these persons. (11) Second, because Montana's American Indian population had small number of deaths due to CVD, heart disease and stroke, three years of data were combined to obtain a sufficiently large sample for analysis. Calculating mortality rates over a period of several years may reduce the impact of chance variability in rates based on small numbers; however, such rates can conceal changes in trends that took place during 1990-2005.

Third, with the addition of multi-race as a race category (starting in 2003), the number of deaths listed as American Indians may be decreased resulting in lower mortality rates. Therefore the mortality rates reported in this document may be an underestimate of the true rate.

MODIFIABLE CVD RISK FACTORS FOR ALL MONTANANS:

From 1990-2005, data on five modifiable risk factors for CVD were obtained from data collected using the Montana Behavioral Risk Factor Surveillance System (BRFSS). (4,6) The Montana BRFSS is an ongoing state-based, telephone survey to gather information regarding personal practices, attitudes, and knowledge of non-institutionalized adult Montanans (18 years of age and older) that contribute to the leading causes of disease in the state. For Montana, data were weighted to account for differences in probability of selection and to more closely reflect the adult population. For the US population (including District of Columbia), the median of the prevalence was used. (4) For the US population, the median of the prevalence of obesity for 2004 and 2005 was obtained for the Morbidity and Mortality Weekly reports. (12,13)

BRFSS questions asked and definitions:

1. Have you ever been told by a doctor that you have diabetes?

2. Have you ever been told by a doctor, nurse or other health professional that you have high blood pressure?

3. Have you ever been told by a doctor, nurse or other health professional that your blood cholesterol is high?

4. A current smoker is defined as someone who has ever smoked 100 cigarettes and who now smokes every day or some days.

5. According to the National Heart, Lung, and Blood Institute (1998), persons with a BMI > 30 kg/m^2 are at risk for being obese.

Respondents who reported pre-diabetes or borderline diabetes were not considered to have diabetes. Female respondents who had been told by a physician or other healthcare professional that they had gestational diabetes or high blood pressure during pregnancy were not considered to have diabetes or high blood pressure.

Respondents who answered they did not know or refused to answer a question were excluded from the calculation of prevalence estimates.

Actions to Control Blood Pressure (Optional Module):

Are you now doing any of the following to help lower or control your high blood pressure?

1. (Are you) changing your eating habits (to help lower or control your high blood pressure)?

2. (Are you) cutting down on salt (to help lower or control your high blood pressure)?

3. (Are you) reducing alcohol use (to help lower or control your high blood pressure)?

4. (Are you) exercising (to help lower or control your high blood pressure)?

Respondents who answered "yes" to any questions 1-4 were reported as taking action to control their high blood pressure. Respondents who reported "Do not use salt" to question 2 or who reported "Do not drink" to question 3 were excluded from further analysis for each of these questions.

Limitations:

First, respondents may have a tendency to underreport behaviors that are socially undesirable, unhealthy or illegal (e.g., drinking and driving or smoking), while over-reported information also is affected by the ability to fully recall past behaviors or health screening results. Second, telephone surveys exclude households without telephones, which may result in a biased survey population due to under-representation of certain segments of the population. An estimated four percent of Montana households are without telephones and may represent a population segment at high risk of preventable disease associated with low socioeconomic status.

MODIFIABLE CVD RISK FACTORS FOR MONTANA AMERICAN INDIANS:

In addition, the Montana Department of Public Health and Human Services (DPHHS), in collaboration with the Billings Area Indian Health Service, conducted an adapted BRFSS telephone survey of adult American Indians (18 years and older) living on or near Montana's seven reservations in 1999-2005. (14,15) Trained interviewers made telephone calls to a random sample of households with three-digit telephone prefixes located on or near the seven reservations in Montana. The number of completed telephone calls was proportional to the number of American Indian households on each reservation according to the 2000 census. Persons 18 years of age and older who reported being American Indians were eligible to participate in the survey. A total of approximately 1,000 surveys of American Indian adults were completed in 1999, 2001, 2003 and 2005.

Limitations:

A number of limitations exist for these analyses. First, the survey was conducted by telephone and does not reflect the experience of adult American Indians living on or near the reservations without telephones. Second, Montana Indians who do not live on or near the reservations were not included in the survey sample. Finally, there is a potential for recall bias, as self-reported information regarding CVD and modifiable risk factors was used.

SELF-REPORTED CARDIOVASCULAR DISEASE:

Montana BRFSS and American Indian adapted-BRFSS was used to assess the prevalence of heart attack or myocardial infarction and stroke from 1999-2005.

BRFSS questions asked:

1. Has a doctor, nurse or other health professional ever told you that you had a heart attack, also called a myocardial infarction (MI)?

2. Has a doctor, nurse or other health professional ever told you that you had a stroke?

Limitations: See limitations above.

HOSPITAL DISCHARGE FOR MONTANA

Discharge data from Montana hospitals for the years 2000 to 2005 were utilized. (16) Cardiovascular disease was defined by the primary diagnosis, and ICD-9 codes used for each disease are listed in the table below. Only Montana residents hospitalized in Montana were included in the database. Montana residents hospitalized in other states were excluded. Over 65% of all acute care inpatient hospitals voluntarily submitted discharge data. Of these hospitals, over 70% had over 90% of discharges reported.

	ICD-9 Codes
Coronary heart disease	410 – 414.99, 429.2
Heart failure	428 – 428.99
Stroke	430 – 437

Limitations:

Data is voluntarily submitted by each hospital and not all hospitals participated, particularly those with the Indian Health Service (IHS), Veterans Administration (VA) and state hospitals.

KNOWLEDGE OF SIGNS AND SYMPTOMS OF HEART ATTACK AND STROKE

Montana BRFSS:

In 2003 and 2005, the Montana BRFSS (see above in Appendix A) survey included questions pertaining to signs and symptoms of heart attack and stroke (6 questions each). The correct response for 5 of the questions, for each of the heart attack and stroke sections was "yes." Both the heart attack and stroke sections included one decoy question that required a "no" response.

Limitations:

In addition to limitations described above, respondents were asked to indicate which of the possible signs and symptoms described by the interviewer were a sign of symptom of heart attack and stroke. Aided questions may overestimate heart attack and stroke awareness and unaided questions may underestimate awareness. These findings are limited to adults from Montana, and our findings may not be representative of adults from other geographic regions.

Community Surveys:

In 2004 and 2005, the Montana Cardiovascular Health Program conducted community awareness campaigns to improve recognition of signs and symptoms of heart attack and stroke. The awareness campaigns focused on adults 45 years

and older and included residents of Cascade and Yellowstone counties, for stroke, and Silver Bow County, for heart attack. Unaided questions were used to assess respondents' knowledge of the warning signs for stroke and heart attack. For the stroke surveys in Cascade and Yellowstone counties, respondents were prompted to name up to three warning signs for stroke. "From what you make have seen or read, can you name three signs or symptoms of stroke." For the Silver Bow heart attack survey, respondents were asked to name up to five signs or symptoms of heart attack. "From what you may have seen or read, can you name five signs or symptoms of heart attack."

Limitations:

There are a number of limitations. First, the surveys do not reflect the experience of residents without telephones. Second, respondents were asked unaided questions to assess respondents' knowledge of warnings signs. It is possible that unaided questions may underestimate the awareness of the warning signs and aided questions may overestimate awareness. Finally, these surveys were conducted in a rural non-Hispanic white population, and there may be significant variation in awareness of warning signs in other geographic and racial and ethnic communities in the US.

County	Population[3]	Population density (Persons/sq mile)
	Small Urban	
Cascade	79,569	29.5
Flathead	83,172	16.3
Gallatin	78,210	30.0
Hill	16,304	5.6
Lewis & Clark	58,449	16.9
Missoula	100,086	38.5
Silver Bow	32,982	45.9
Yellowstone	136,691	51.9
	Frontier	
Beaverhead	8,773	1.6
Big Horn	13,149	2.6
Blaine	6,629	1.6
Broadwater	4,517	3.8
Carbon	9,902	4.8
Carter	1,320	0.4
Choteau	5,463	1.4
Custer	11,267	3.0
Daniels	1,836	1.3
Dawson	8,688	3.7
Deer Lodge	8,948	12.1
Fallon	2,717	1.7
Fergus	11,551	2.7
Garfield	1,199	0.3
Glacier	13,552	4.5
Golden Valley	1,159	1.0
Granite	2,965	1.7
Jefferson	11,170	6.7
Judith Basin	2,198	1.2
Lake	28,297	18.9
Liberty	2,003	1.4
Lincoln	19,193	5.3
McCone	1,805	0.7
Madison	7,274	2.0
Meagher	1,999	0.8
Mineral	4,014	3.3
Musselshell	4,497	2.4
Park	15,968	5.7
Petroleum	470	0.3
Phillips	4,179	0.8
Pondera	6,087	3.8
Powder River	1,705	0.5
Powell	6,999	3.0
Prairie	1,105	0.6
Ravalli	39,940	16.7
Richland	9,096	4.4
Roosevelt	10,524	4.5
Rosebud	9,212	1.8
Sanders	11,057	4.0
Sheridan	3,524	2.1
Stillwater	8,493	4.7
Sweet Grass	3,672	2.0
Teton	6,240	2.8
Toole	5,031	2.6
Treasure	689	0.7
Valley	7,143	1.5
Wheatland	2,037	1.4
Wibaux	951	1.1
TOTAL	**935,670**	**6.4**

REFERENCES

1. Eberhardt MS, Ingram DD, Makus DM, et al. Urban and Rural Health Chartbook. Health, United States, 2001. Hyattsville, Maryland: National Center for Health Statisitics, 2001.

2. U.S. Census Bureau, 2005 American Community Survey. (Accessed 1/15/07).
Website: http://factfinder.census.gov

3. The Economist, December 8, 2005, "The Poorest Part of America."

4. Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System Survey Data. Atlanta, Georgia: U.S. Department of Health and Human Service, Centers for Disease Control and Prevention, 1990-2003.
Website: http://www.cdc.gov/brfss

5. US Department of Health and Human Services, Healthy People 2010. 2nd ed. Understanding and Improving Health and Objectives for Improving Health. Two vols. Washington DC:US Government Printing Office. November 2000.
Website: http://www.healthypeople.gov

6. Personal Communication, Susan Cummings, BRFSS Coordinator, Montana Department of Public Health and Human Services. Helena, MT: Montana DPHHS, 2007.

7. Office of Vital Statistics, Operations and Technology Division, Montana Department of Public Health and Human Services.

8. US Census Bureau: http://www.census.gov and American Fact Finder: http://www.factfinder.census.gov/servlet/basicfactsservlet

9. United States Department of Health and Human Services (USDHHS), Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS), Compressed Mortality File (CMF) compiled from CMF1968-1988, Series 20, No. 2A 2000, CMF 1989-1998, Series 20, No. 2E 2003 and CMF 1999-2003, Series 20, No. 2H 2004 on CDC WONDER On-Line Databases.

10. Minino AM, Heron MP, and Smith BL. Deaths: Preliminary Data for 2004. National Vital Statistics Report; vol 54 no. 19; Hyattsville, Maryland: National Center for Health Statistics. 2006.
http://www.cdc.gov/nchs.

11. Harwell TS, Hansen D, Moore KR, Jeanotte D, Gohdes D, Helgerson SD. Accuracy of race coding on American Indian death certificates, Montana 1996-1998. Public Health Reports 2002 Jan-Feb; 117(1):44-9.

12. Blanck HM, Dietz WH, Galuska DA, et. al. State-specific prevalence of obesity among adults – United States, 2005. MMWR;Vol 55, No MM36;985.
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5536a1.htm

13. Lina Balluz L, Ahluwalia IB, Murphy W, Mokdad A, Giles W, Harris VB. Surveillance of certain health behaviors among states and selected local areas – Behavioral Risk Factor Surveillance System, United States, 2004. MMWR; 55, No 227;1.
http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5305a1.htm

14. Harwell TS, Gohdes D, Moore K, McDowall JM, Smilie JG, Helgerson SD. Cardiovascular disease and risk factors in Montana American Indians and non-Indians. Am J Prev Med 2001 Apr; 20(3):196-201.

15. Montana Department of Public Health and Human Services. Discouraging Trends in Cardiovascular Disease Risk Factors among Montana American Indians compared to all Montanans, 1999 to 2005. Montana Clinical Communication Surveillance Report. October – December 2006:1-10.

16. MHA – An Association of Montana Health Care Providers, Discharge data 2000 – 2005.

This publication was supported through a cooperative agreement (U50/CCU821287-05) with the Centers for Disease Control and Prevention, Division for Heart Disease and Stroke Prevention and through the Montana Department of Public Health and Human Services. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the US Department of Health and Human Services.

The Montana Department of Public Health and Human Services attempts to provide reasonable accommodations for any known disability that may interfere with a person participating in any service, program or activity of the Department. Alternative accessible formats of this document will be provided upon request. For more information call (406) 444-5508.

1,000 copies of this public document were published at an estimated cost of $5.57 per copy, for a total cost of $5,566.75, which includes $5,566.75 for printing and $0.00 for distribution.